REMARKS

Claims 1 – 39 and 41 – 75 of the present application are pending. Claim 40 has been cancelled and claims 38, 39, 41, 43, 44, 51, 52, and 75 have been amended. No new matter has been added.

Claims 38 and 39 have been amended to specify that the reaction occurs without a catalyst. In addition, claim 38 has been amended to correct a typographical error; namely, the term "halopropene" has been replaced with the term "halopropane". Support for these amendments can be found, for example, in the original specification at page 4, lines 2 – 4 and lines 8 – 10, respectively. Thus, no new matter has been added.

In view of the amendments to claim 39, claim 41 has been amended so that it is now an independent claim.

Claims 43 and 44 have been amended to correct dependency. In addition, claim 41 has been amended to include transition metal oxides catalysts. Support for this amendment is found in the original specification at page 6 lines 17 - 27 and page 7 lines 1 -10.

In view of the amendments to claim 38, claim 51 has been amended so that it is now an independent claim.

Claim 52 has been amended to specify that catalysts are supported or bulk transition halides.

Claims 52 and 75 have been amended to correct minor punctuation errors; namely, a period has been inserted at the end of each claim. Also, claim 75 has been amended to correct a typographical error; namely the dependency of claim 75 is now on claim 38 instead of claim 35. Support for this amendment can be found in the original specification at page 14, lines 2 – 7.

Summary of the Invention As Presently Claimed:

The present claims are directed to novel methods of producing fluoropropenes, such as HFC-1234ze, via a dehydrohalogenation process. The claimed processes involve using a halopropane, such as HFC-245fa, HFCF-244fa, or HCC-240fa as a reactant.

According to a first aspect of the invention as now claimed (see claims 1 to 37, 73 and 74), a halopropane is reacted with at least one alkali or alkaline metal hydroxide in a non-aqueous, non-alcoholic solvent that is miscible with the halopropane, at a temperature at which dehydrohalogenation will occur (preferably from about 20° C to about 150° C). This reaction preferably occurs without a catalyst (see for example, claims 1 - 18). According to a second aspect of the invention, as now claimed the halopropane is reacted under conditions at which dehydrohalogenation occurs (see claims 38, 39, 41 – 47 and 75) by thermal decomposition at about 30° C to about 400° C (see claim 46). The processes according to these claims may be conducted with or without a catalyst. In embodiments that utilize a dehydrohalogenation catalyst, preferable

catalysts include iron halides, nickel halides, cobalt halides, and combinations thereof.

In certain embodiments, the presently claimed methods include a preliminary step wherein the halopropane reactant is synthesized. An example of such a preliminary step is reacting HCC-240fa with HF in the presence of a fluorination catalyst, such as chromium oxides. Applicants acknowledge that processes for preparing certain halopropanes are known in the art (see Specification p. 5, lines 17 – p. 6, line 4). However, the claims as now presented are directed to methods of producing fluoropropenes by a reaction which, in certain instances, may also include a step for preparing halopropane reactants.

Double Patenting Rejection:

The Office has rejected claims 1, 5, 7 – 12, 14, 15, and 38 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 7, and 32 of co-pending Application No. 10/671,810.

In response to this rejection, and without acceding to the correctness of the Examiner's rejection of the reasons therefore, Applicants will consider filing, in the event that the pending subject matter is indicated as being allowable, a Terminal Disclaimer wherein Applicants disclaim the terminal part of any patent granted on the present application which would extend beyond the expiration date of a patent granted on Application No. 10/671,810.

Rejection Under 35 U.S.C. § 112:

The Office has rejected claim 38 under 35 U.S.C. § 112, second paragraph, as being indefinite. Specifically, the Office notes that claim 38 recites the thermal decomposition of a "halopropene" instead of a "halopropane". As indicated above, claim 38 has been amended to replace the term "halopropene" with "halopropane". In consideration of this amendment, Applicants respectfully request that this rejection is now moot and should be withdrawn.

Rejection of Claims 38, 39, 41, and 46 – 49 Under § 102(b):

Claims 38, 39, and 46 – 49, as originally written, were directed to thermal decomposition dehydrohalogenation processes without regard to the use or absence of catalysts. Original claim 51 was directed to a thermal decomposition dehydrohalogenation process that included the use of a catalyst, and original claims 41 and 52 specified that such catalysts are transition metal halides or oxides. The Office asserts that these claims are anticipated by Elsheikh's disclosure of a process for preparing HFC-1234ze via dehydrofluorination of HFC-245fa in the presence of a chromium-based catalyst and at a temperature of 100 – 600° C and under atmospheric pressure.

According to MPEP § 2131, a reference is anticipatory under 102(b) only if each and every element set forth in the claimed invention is found in the cited reference. Claims 38, 39, and 46 – 49, as now presented, are directed to a dehydrohalogenation process conducted *without a catalyst*, while claims 41, 51,

and 52, are directed to a dehydrohalogenation process conducted in the presence of a *transition metal halide catalyst*. These aspects of the claimed invention, namely non-catalytic reactions and reactions involving transition metal halide catalysts, are neither taught nor even suggested by Elsheikh. Thus, Elsheikh does not anticipate, and, the pending claims. Accordingly, Applicants respectfully request that this rejection be withdrawn.

Rejection of Claims 42 – 45, 50, and 53 – 71 Under § 103(a):

Claims 42 and 53, as originally written, were directed to a thermal decomposition dehydrochlorination processes that involved the use of transition metal halide catalysts. Original claims 43 – 45 were directed to a dehydrochloronation process without regard to the use or absence of catalysts. Original claim 50 was directed to thermal decomposition processes conducted at superatomspheric pressure without regard to the use or absence of catalysts. Original claims 54 – 71 were directed to thermal decomposition dehydrohalogenation processes without regard to the use or absence of catalysts wherein the halopropane reactant is prepared via a catalytic fluorination process.

The Office has rejected the above-mentioned claims as being made obvious by Elshiekh. Specifically, the Office has stated that "while Elshiekh et al. do not expressly teach the absence of a catalyst, it would have been obvious to a person skilled in the art to conduct the dehydrohalogenation with or without a catalyst...[t]here is nothing in the reference that suggests that the

dehydrohalogenation reaction would not proceed in the absence of a catalyst." *See* Office Action of 01/19/2005, p. 6.

Applicants respectfully disagree with the Office's conclusions for at least four reasons: (1) with respect to claims 42 and 53, the Office has not shown that Elshiekh, alone or in combination with other references, teaches or suggests the use of transition metal halide catalysts in dehydrohalogenation process; (2) with respect to claims 43 – 45, 50, and 54 – 71, the Office has not provided any reference, or combination of references, that teaches or suggests a non-catalytic thermal decomposition dehydrohalogenation process; (3) it is contrary to established case law to assert that claims 43 – 45, 50, and 54 – 71 are obvious in view of Elsheikh in light of the fact that these claims expressly omit an element found in the method described in Elsheikh (i.e. a catalyst for hydrogen halide removal) while retaining the Elsheikh method's functionality (i.e. the synthesis of a fluoropropene); and (4) it is logically erroneous to conclude that Elshiekh suggests a non-catalytic reaction merely because it does not explicitly state that such a reaction is impossible.

Regarding the first reason, the Office has not provided a reference that teaches or even suggests the use of transition metal halide catalyst in preparing fluoropropenes via a dehydrohalogenation process. The Office cites Elsheikh in view of US 5,574,192 (Van Der Puy), for the proposition that one skilled in the art would know to combine the fluorination process of Van Der Puy (which teaches the use of transition metal halide fluorination catalyst) with the catalytic

dehydrofluorination process of Elsheikh to produce the indicated fluoropropenes. However, the catalysts of Van Der Puy are clearly limited to fluorination processes – not dehydrofluorination. It is untenable to maintain that the use of a metal halide catalyst to *dehydrohalogenate* a hydrohalopropane *reactant*, such as HFC-245fa, to produce a hydrofluoropropene is made obvious by a teaching wherein a metal halide catalyst is used to *fluorinate* a compound to produce a hydrohaloproane *product*, such as HFC-245fa. Moreover, Applicants note that the transition metals used in Van Der Puy include antimony, niobium, arsenic, and tantalum, whereas preferred metals of the present catalyst are iron, nickel, and cobalt. Accordingly, the Office has not shown that Elsheikh alone, or in combination with other references, suggests the use of transition metal halide catalysts in preparing fluoropropenes.

Regarding the second reason, the Office has rejected claims directed to a non-catalytic reaction but does not cite any references which teach or even suggest such a non-catalytic reaction. That is, the Office has rejected these claims as being obvious over Elsheikh in view of Van Der Puy, although neither of these patents disclose a non-catalytic thermal decomposition process for synthesizing halopropenes. The Office attempts to argue that a *non-catalytic* dehydrofluorination reaction involving a halopropane reactant and fluoropropene product would be made obvious by a teaching of a *catalytic* dehydrofluorination reaction involving the same reactant and product. Such an argument is not only conclusory, it is contrary to widely established perceptions of catalytic systems.

It is well understood that catalysts provide an *alternative* pathway, with a lower activation energy, for a reaction to proceed. This means that catalysts reduce the amount of energy needed to start a chemical reaction. Molecules that would not have had the energy to react or that have such low energies that they probably would have taken a long time to react are able to react in the presence of a catalyst. Applicants acknowlege that, in theory, a reaction may proceed without a catalyst, albeit possibly at an infinitesimally slow rate. Nevertheless, the disclosure of a catalytic reaction would not, by itself, lead one skilled in the art to believe that such a reaction would be practically possible without a catalyst. Stated another way, catalytic and noncatalytic reactions proceed via different pathways and, thus, one skilled in the art would not necessarily know that a catalytic reaction could be achieved via a noncatalytic pathway.

Regarding the third reason, the Office asserts that it would have been obvious to omit the catalyst in the process taught by Elsheikh to arrive at the present invention. MPEP § 2144.04 clearly states that the "omission of an element with retention of the element's function is an indicia of unobviousness." See also *In re Edge*, 359 F.2d 896 (CCPA 1966). Clearly, the catalytic reaction disclosed in Elsheikh involves the use of a chromium-oxide catalyst and that the function of this catalyst is to convert HFC-245fa into HFC-1234ze. In contrast, applicants have discovered a process for converting halopropanes, such as HFC-245fa, into fluoropropenes, such as HFC-1234ze, via a thermal decomposition process that does not require the use of a catalyst. Thus, the

invention as now claimed produces a halopropene even though a critical element taught by Elsheikh is absent. Such an omission should not be viewed as obvious, but on the contrary, should be considered as an indicia of unobviousness.

Regarding the fourth reason, the Office attempts to argue that because Elshiekh does not explicitly state that a non-catalytic reaction is impossible, one can conclude that such a reaction is possible. Such an inference is not logically supportable. The existence of particular subject matter is not justified merely because a reference does not affirmatively state the contrary.

Considering that neither Elsheikh nor Van Der Puy teach or even suggest a method for preparing fluoropropenes involving either a non-catalytic reaction or a reaction conducted in the presence of a transition metal halide catalyst, claims 40, 42 – 45, 50, and 53 – 71 are not obvious in view of these patents and should therefore be allowed.

Rejection of Claims 1 – 37 and 72 – 75:

Claims 1 – 37 and 72 – 74 are directed to a process for preparing fluoropropenes via reacting, without a catalyst, a halopropane with an alkali metal or alkaline metal hydroxide in a *non-aqueous, non-alcoholic* solvent that is essentially miscible with the halopropane reactant. (Applicants note that claim 75 has been amended to be dependent from claim 38 instead of claim 35.)

The Office has rejected the above-mentioned claims as being obvious over Elskeikh in view of US 5,574,192 (Nair), and further in view of Van Der Puy. The Office states that Elsheikh teaches a process for preparing HFC-1234ze by dehydrofluorinating HFC-245fa with a strong base such as an *aqueous* or *alcoholic* solution of sodium hydroxide or potassium hydroxide. The Office notes that Elsheikh does not teach the solvents of the presently claimed invention but that Nair teaches a process for preparing fluoroolefins using a reaction solvent such as alcohol, ethers, esters, alkanes, and the like. Based upon these disclosures, the Office concludes that it would have been obvious to conduct the dehydrofluorination process taught by Elsheikh in the presence of a solvent taught by Nair because a person of ordinary skill in the art would have been motivated to employ to solvents of Nair by the desire to modify the system viscosity as suggested by Nair.

Applicants respectfully disagree with the Office's conclusions for at least two reasons: (1) Nair does not describe a non-aqueous, non-alcoholic solvent, but instead describes an aqueous solvent that may be modified by the addition of an alcohol, ether, ester, etc.; and (2) there is no basis for the conclusion that one skilled in the art to desire to modify the viscosity of the present invention via use of the solvents taught by Nair.

Regarding the first reason, Nair states at column 3 lines 40 – 48:

> The dehydrohalogenation reaction can be accomplished using an *aqueous solution* of at least one alkali metal hydroxide, *without the need for additional solvent or diluent*, other than the water present as a consequence of using aqueous base or alkali metal hydroxide.

> However, a solvent or diluent can be used if desired for convenience in carrying out the process, e.g., to modify the system viscosity, to act as a preferred phase for reaction by-products, or to increase thermal mass, etc. (emphasis added)

Contrary to the Office's conclusions, Nair actually teaches away from the present claimed non-aqueous, non-alcoholic solvent as evidence by the fact that Nair clearly discloses the use of an *aqueous* solvent that may be used without any additional solvents. Merely because Nair indicates that *additives* such as alcohols, ethers, esters, etc. may be included in such an aqueous solvent "if desired for convenience", does not mean that Nair in any way teaches a solvent having no water or alcohol (i.e. a non-aqueous, non-alcoholic solvent).

The above noted claims, as amended, describe a non-aqueous solvent, and applicants have found that such a solvent affords better solubility for the halopropane reactant. In order for this reaction to proceed efficiently, the halopropane is preferably in contact with the caustic. This physical contact is facilitated by creating solutions in which the halopropane and hydroxide are both miscible. Since halopropanes are insoluble in water, the solvent is preferably non-aqueous. Halopropanes and hydroxides are, however, soluble in certain polar solvents. Yet using alcohol as a solvent has several disadvantages including the fact that it is hazardous (e.g. flammable), it may not be an adequate solvent for the organic phase, and it may cause reaction by-products that would be difficult to separate by conventional purification

techniques. Applicants have discovered that certain non-aqueous, non-alcoholic solvents, such as acetonitrile, are ideally suited for use with this aspect of the invention as now claimed.

Regarding the second reason, the Office argues that one skilled in the art would be motivated to use the solvents of Nair by a desire to modify the viscosity of the reactants of the present invention. This argument is purely conclusory in as much as the present invention does not even mention viscosity as a parameter to be considered. There is simply no basis whatsoever – either in the present invention or in Nair – upon which one could conclude that a person skilled in the art would have a desire to modify the viscosity of the reactants which are described in the present claims.

Elskeikh, Van Der Puy, and Nair do not teach or even suggest non-aqueous, non-alcoholic reaction solvents, and, for at least the reasons indicated above, claims 1 – 37 and 72 – 74 are unobvious in view of these patents.

In view of the aforementioned claim amendments and the foregoing remarks, applicants assert that the present claims are in condition for allowance and request that the Office issue a Notice of Allowance at the earliest possible date.

Enclosed herewith is a payment for a one-month extension of time for replying to the Office Action. If any additional fees are required in order to further

the prosecution of this application, the Office is invited to charge such fees to Deposit Account No. 19-5425.

The Office is invited to contact the undersigned by telephone in order to further the prosecution of this application in any way.

Respectfully submitted,

Date: May 19, 2005

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